

CLARK SOLUTIONS

Infrared Thermometers

Technical bulletin: Infrared Tutorial

WHAT IS THE HISTORY OF INFRARED TEMPERATURE MEASUREMENT?

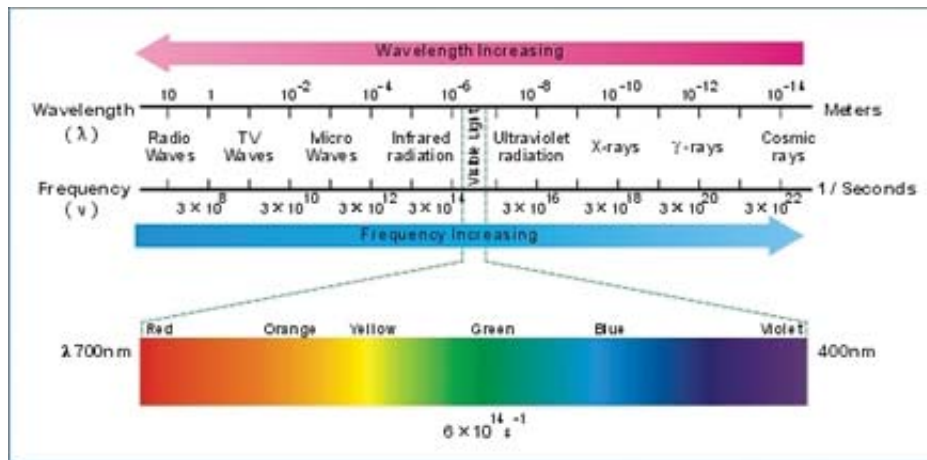
The Royal Astronomer Sir William Herschel discovered "Dark Heat" radiation in 1800. In 1880 the term "infrared" was coined. Samuel Langley invented the bolometer that measures variations of resistance when heated. In 1901 a bolometer could detect a cow at 400 meters. After World War II, many countries invested huge amounts of money in IR for military applications. In 2002 Radiant Innovation Incorporated designed the most compact and the most affordable IR thermometer (IRT). Low cost IR thermometers are achieved by using proprietary ASIC System on a Chip (SoC) technology incorporating MEMS-based advanced thermal sensors. This advanced low-power design also resulted in the longest battery life of any available IR thermometer (70hours continuous use).

WHAT IS INFRA RED?

Infra red just like any light ray, is an Electromagnetic Radiation, with lower frequency (or longer wavelength) Anything material above absolute zero (-273.15 degrees Celsius or 0 Kelvin), radiates in the infrared. Even ice emits infrared radiation.

WHY CAN'T I SEE INFRARED?

Human eyes are designed for visible light, but two species are known to detect IR: some rattle snakes and beetles. Even though IR is not visible to the human eye, your skin can sense IR. When beside a campfire, you can feel the warmth of heat radiated from the fire.



WHAT KIND OF THEORY & TECHNOLOGY IS INVOLVED IN AN IR THERMOMETER?

Quantum physics is the key theory: the total radiation energy is proportional to the fourth power of the absolute temperature (Stefan-Boltzmann Law). Wien Displacement Law: the product of the peak wavelength and the temperature is found to be a constant. Wien was awarded the Nobel Prize for Physics for the year 1911.

INFRARED - HOW IT WORKS

The sensor in an IR thermometer collects a small amount of energy (usually 0.0001 watt) radiated from the target, generates an electrical signal that is amplified by a precision amplifier and converted into voltage output. A CPU digitizes the signal by a 16bit Analog-to-Digital Converter, an Arithmetic Unit solves a temperature equation based on Planck's Radiation Law, compensates for the ambient temperature and emissivity resulting in a temperature reading within a fraction of a second after you push the "read" button on the IR thermometer.

FAQ

COMPETITIVE IR THERMOMETERS ARE MUCH LARGER THAN CLARK'S. CLARK IRTS ARE AS SMALL AS THE BATTERY OF SOME TRADITIONAL IR THERMOMETERS. IS ACCURACY COMPROMISED?

Accuracy is not compromised. Each IR Thermometer has a test report in our calibration database, which is traceable by the serial number. Calibration tests adhere to "ASTM E1256. Test Methods for Radiation Thermometers (Single Waveband Type)"

CAN IR THERMOMETER MEASURE AIR TEMPERATURE?

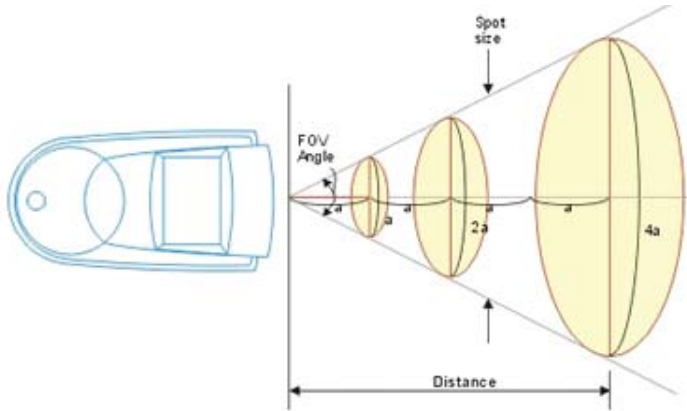
Yes and no. No, because air (i.e., Oxygen and Nitrogen molecules) does not emit infrared radiation. However, you can aim an IR thermometer at anything having the SAME temperature as the air such as a leaf or grass (under sunshade) or indoors such as your desk, a piece of paper having the same temperature as the air. The key to measuring "air temperature" is to measure "anything that should have the same temperature as the air".

CAN I MEASURE THE BODY TEMPERATURE OF AN ANT BY INFRARED MEASUREMENT TECHNOLOGY?

You can aim the IR thermometer at small object such as an ant, but what you measure is an average temperature of the ant & the adjacent surface because the Field-Of-View of the IR thermometer is much larger than the ant. But, if a large collection of ants occupies the whole FOV of the IR thermometer, then one can measure their average body temperature. This FOV is the main consideration to obtaining the correct temperature reading from IR thermometer.

HOW FAR AWAY CAN I MEASURE?

Can one measure the temperature of a wall from a 5-meter distance or the temperature of a mountain



from 1km? Yes as long as the FOV is filled by the target. Also, many IRTs measure in the 8um to 15um wavelength band where the atmosphere is almost totally transparent.

WHAT IS DS (DISTANCE TO SPOT) RATIO?

As the distance (D) from the object increases, the diameter (S) of the area measured by the unit becomes larger. DS ratio number is like a microscope rating, in the same Distance area, higher DS ratio unit can narrow the measured area.

CAN THE IR THERMOMETER OPERATE IN COMPLETE DARKNESS?

Yes, that's why DOD & military are interested in IR. In fact, early IR technology was developed by the military.

CAN THE IRT PENETRATE A BUILDING, MEASURE WHAT'S INSIDE?

No, because an IRT measures surface temperature.

BUT I REMEMBER IR CAN PENETRATE SOMETHING?

In the 8um to 15um wavelength band IR can penetrate PE film (for example: a plastic trash bag). You can hide something warm behind a PE film (such as your hand) and the IR thermometer can detect the presence of the object.

NOW CAN I MEASURE THE BODY TEMPERATURE OF A FISH IN MY AQUARIUM?

No, water & glass are transparent for visible light, but for IR, it's almost completely "opaque". One can only measure the temperature of the glass. How about my pet's temperature? by pointing an IR thermometer at your dog, you measure the surface temperature of the fur. What you see is what you get.

HOW DO I KNOW, MY IR THERMOMETER IS STILL ACCURATE?

Calibration of an IRT is extremely sophisticated, that's why traditional IRTs are so expensive, but not Clark IRTs. The manufacturer, Radiant Innovation Incorporated (RII), has developed proprietary CCE (Continuous Calibration Equipment), which simultaneously calibrates up to 128 IRTs, at different temperatures, in a continuous, high-throughput production operation. RII is ISO9001 certified.

HINTS FOR AN ACCURATE IR TEMPERATURE MEASUREMENT

The target must occupy the entire FOV(Field Of View) of the IR thermometer.
Avoid shining surfaces (metal), rough surfaces give better accuracy (because of higher emissivity)
Adding Electrical Insulating Tape (black is better) on the metal surface, can solve the problem, and give accurate result.

Be sure the tape is large enough to cover to Field Of View of the IR thermometer.

Be sure the tape will not BURN. Use with caution!

Avoid temperature errors by not viewing nearby high-temperature objects. Try to be perpendicular to the target surface.